

# **CSR-External-Target-Facility Experiment (CEE)**

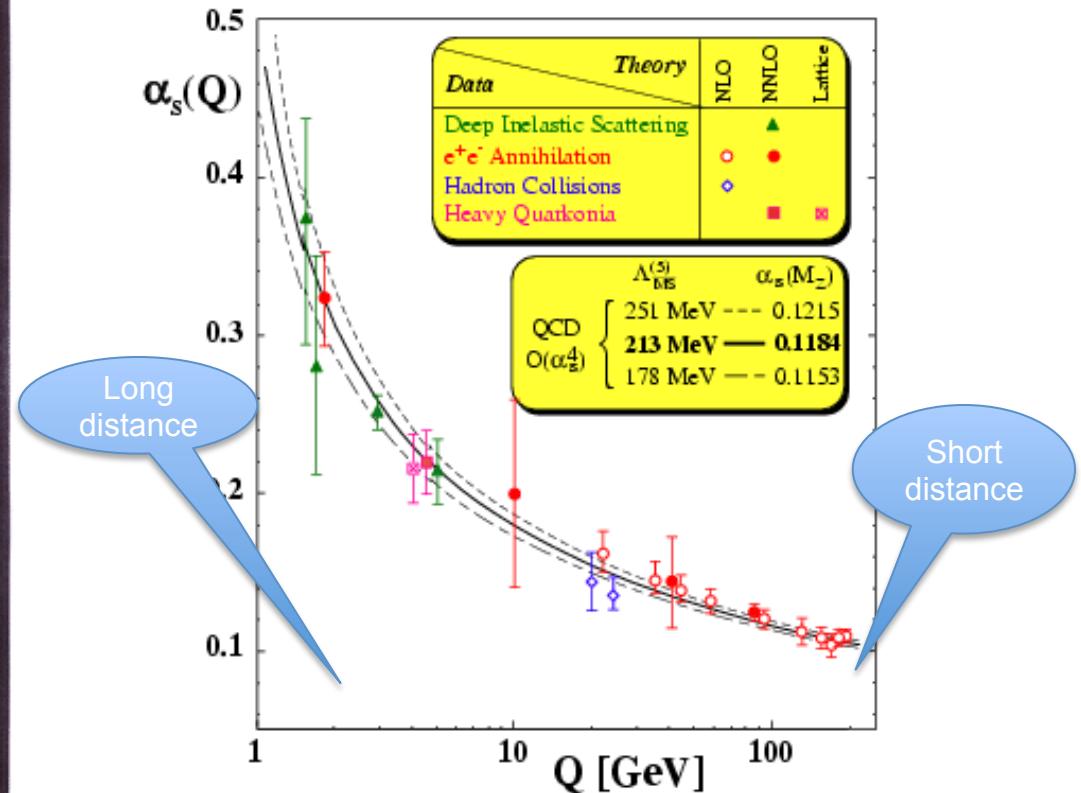
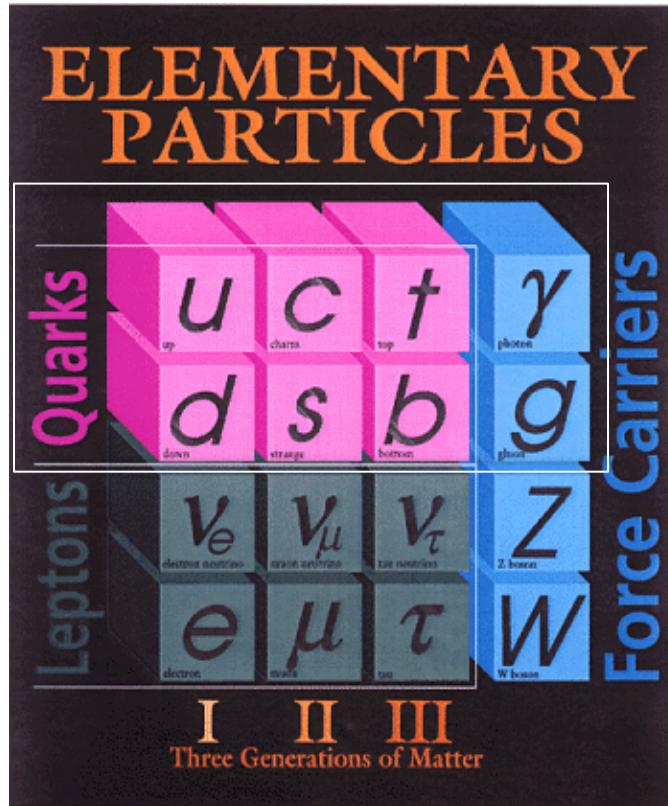
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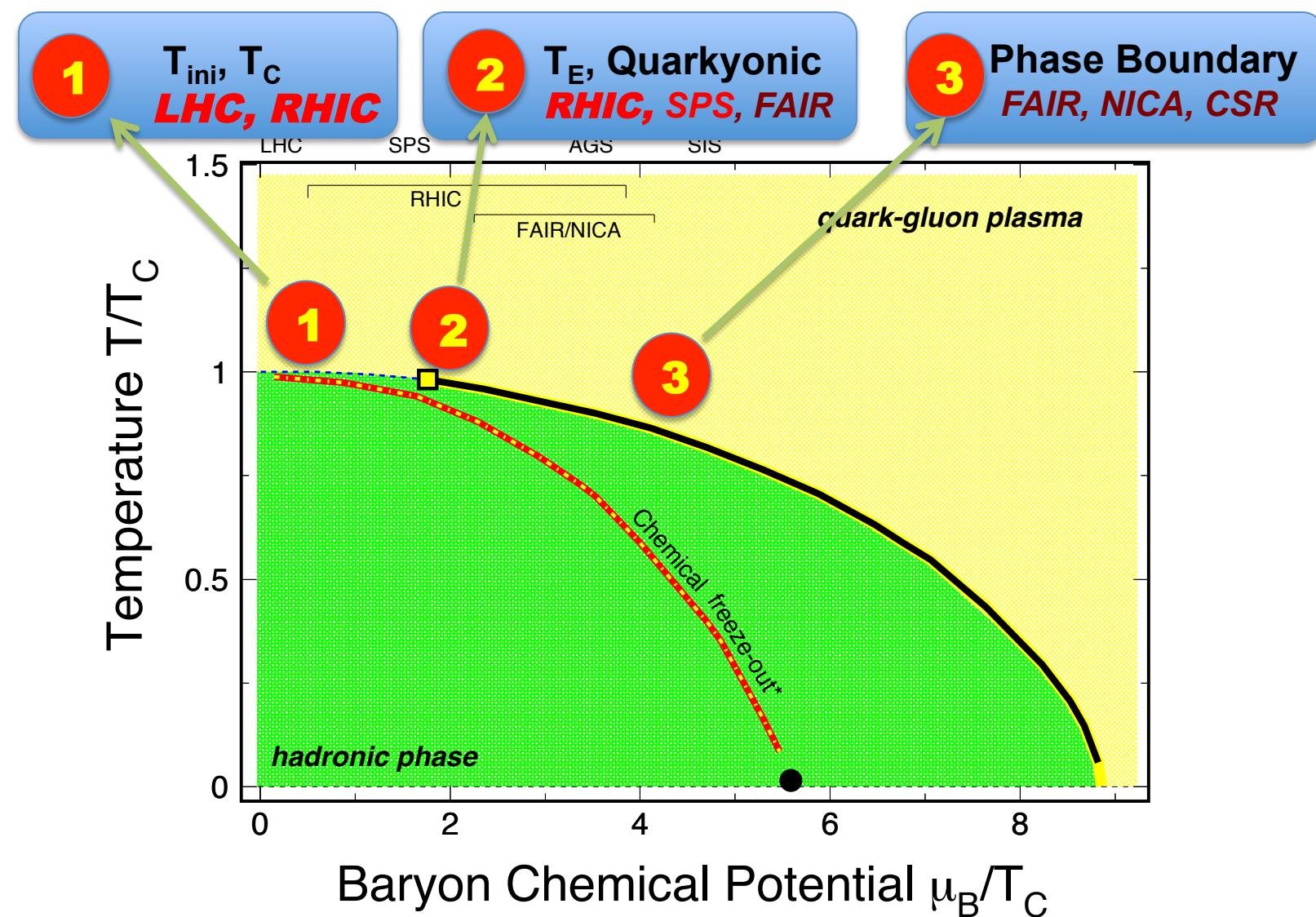


# Quantum ChromoDynamics



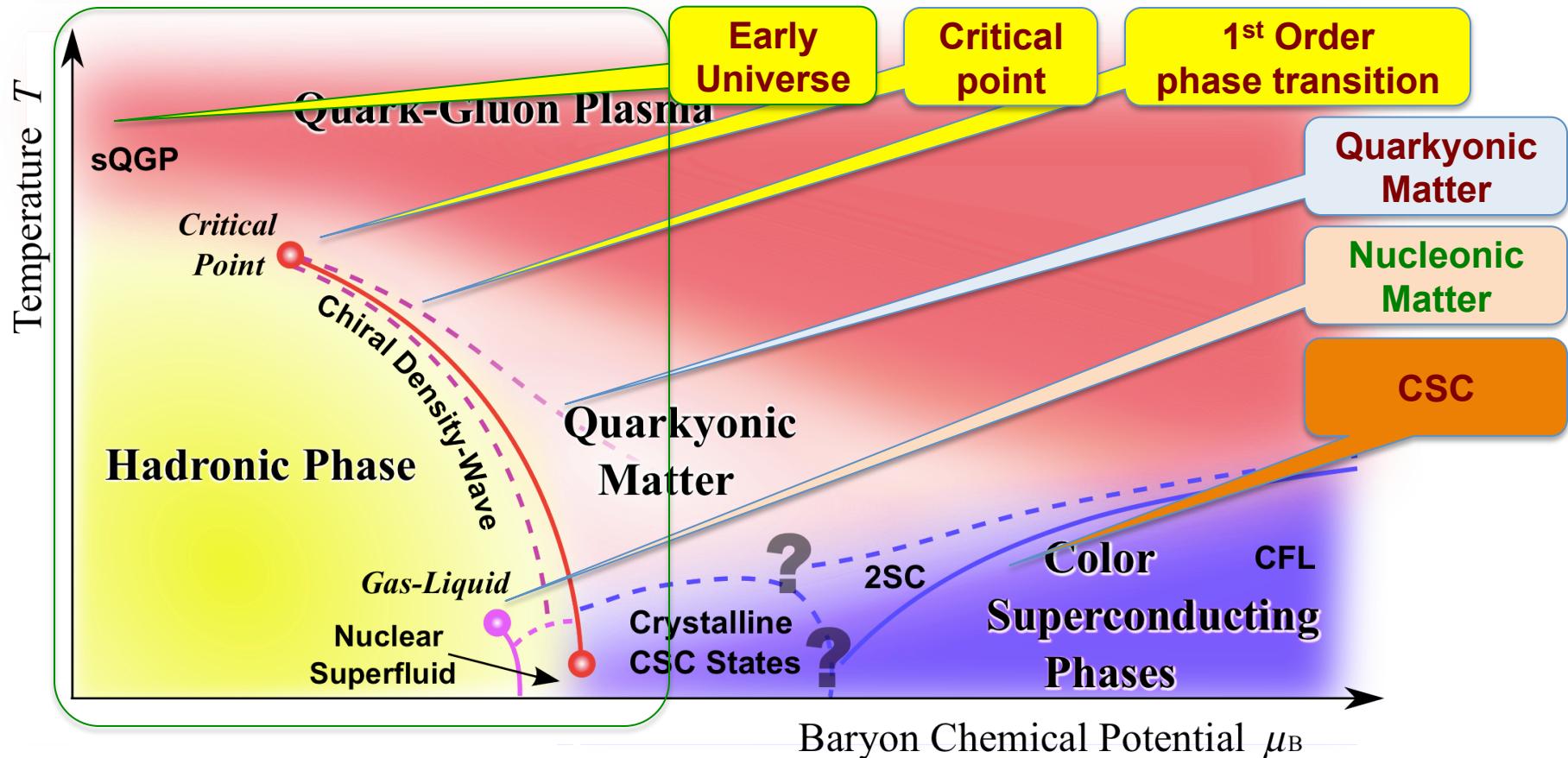
- 1) QCD is the basic theory for strong interaction. Its degrees of freedom are well defined at short distance.
- 2) Little is known regarding the dynamical structures of matter, e.g. *the confinement, nucleon spin, the QCD phase structure...* Large  $\alpha_s$  and strong coupling – QCD at long distance.

# The QCD Phase Diagram and High-Energy Nuclear Collisions



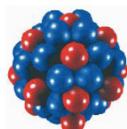


# QCD Phase Diagram (2010)



A. Anton, et al. 0911.4806; K. Fukushima and T. Hatsuda, *Rept. Prog. Phys.* **74**, 014001(2011); arXiv: 1005.4814

- 1) Extreme high baryon density, low temperature
- 2) Hadronic interactions dominant
- 3) Rich physics: Phase structure, Neutron star, CSC, Quarkyonic matter ...

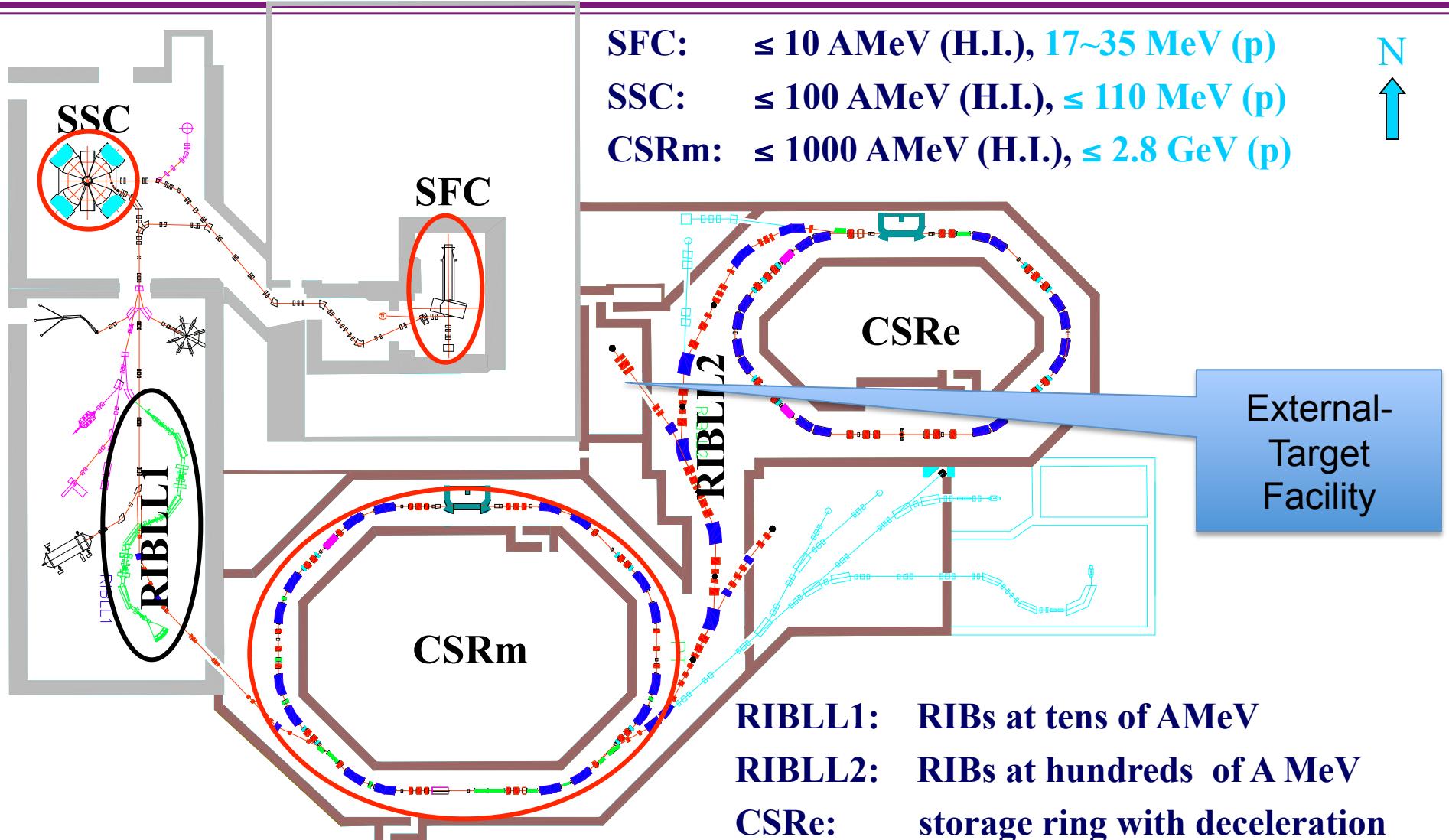


# *Why CEE?*

- 1) Study ***QCD phase structure*** at extremely high baryon density
- 2) The ***base*** for Chinese nuclear physics and the ***state of art technology***
- 3) Training next generation ***scientists***



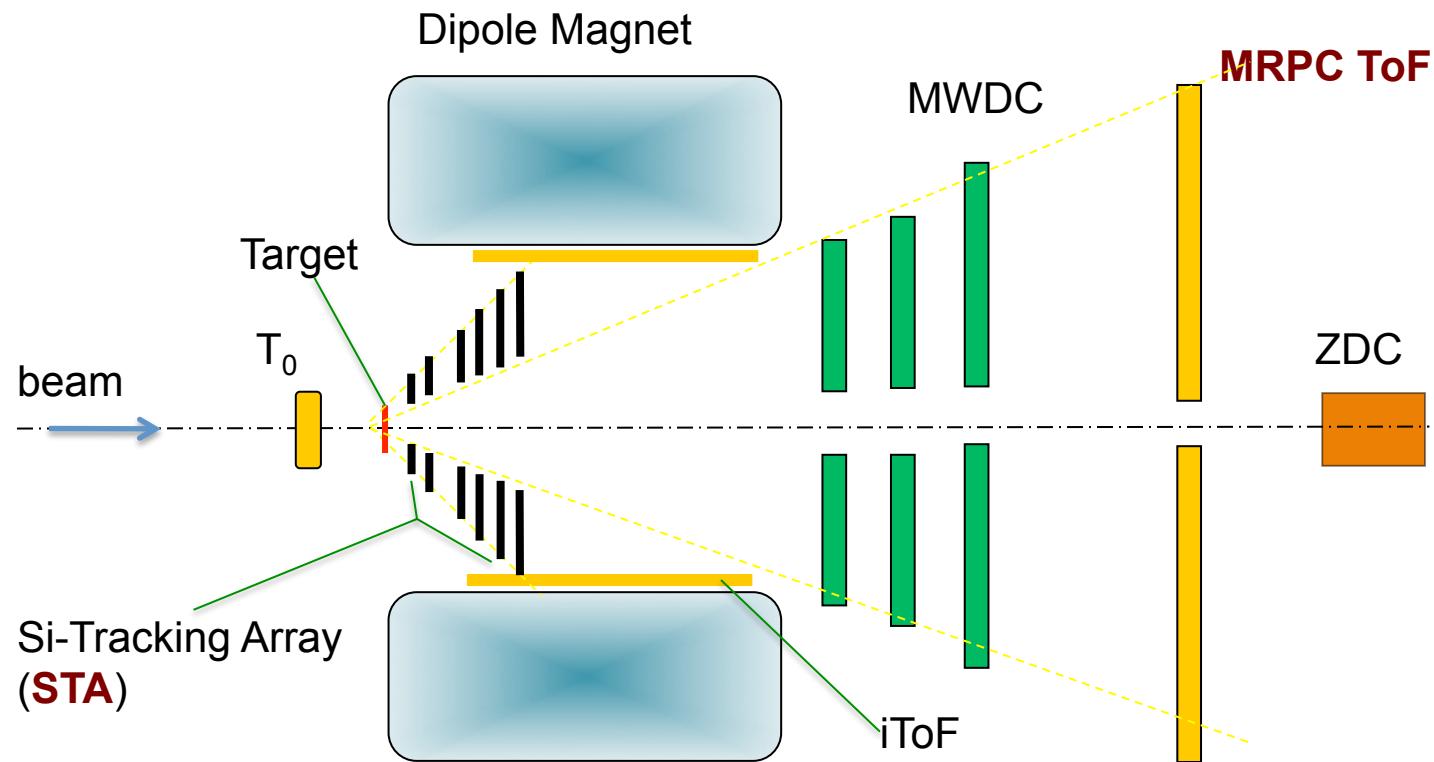
# HIRFL-CSR Heavy Ion Beam





# CEE 概念性设计

## CSR-External-Target-Facility Experiment



**State of art technology:**

- 1) Si pixel detector array (IMP, CCNU)
- 2) High counting rate time-of-flight detector (TU, USTC)
- 3) New data acquisition system (USTC)



# Observables and Participating Institutes

## (I) Observables: ( $\pi$ , nucleon and light nuclei)

- 1) production yields, including light-clusters
- 2) azimuthal distributions:  $v_n$ :  $n=0, 1, 2, 3$
- 3) net-charge  $\Delta_{ch}$ , net-proton  $\Delta_p$  fluctuations

## (II) 参加单位:

- 1) 华中师范大学
- 2) 中国科技大学
- 3) 清华大学
- 4) 山东大学
- 5) 北京大学
- 6) 中国科学院上海应用核物理所
- 7) 中国科学院近代物理所



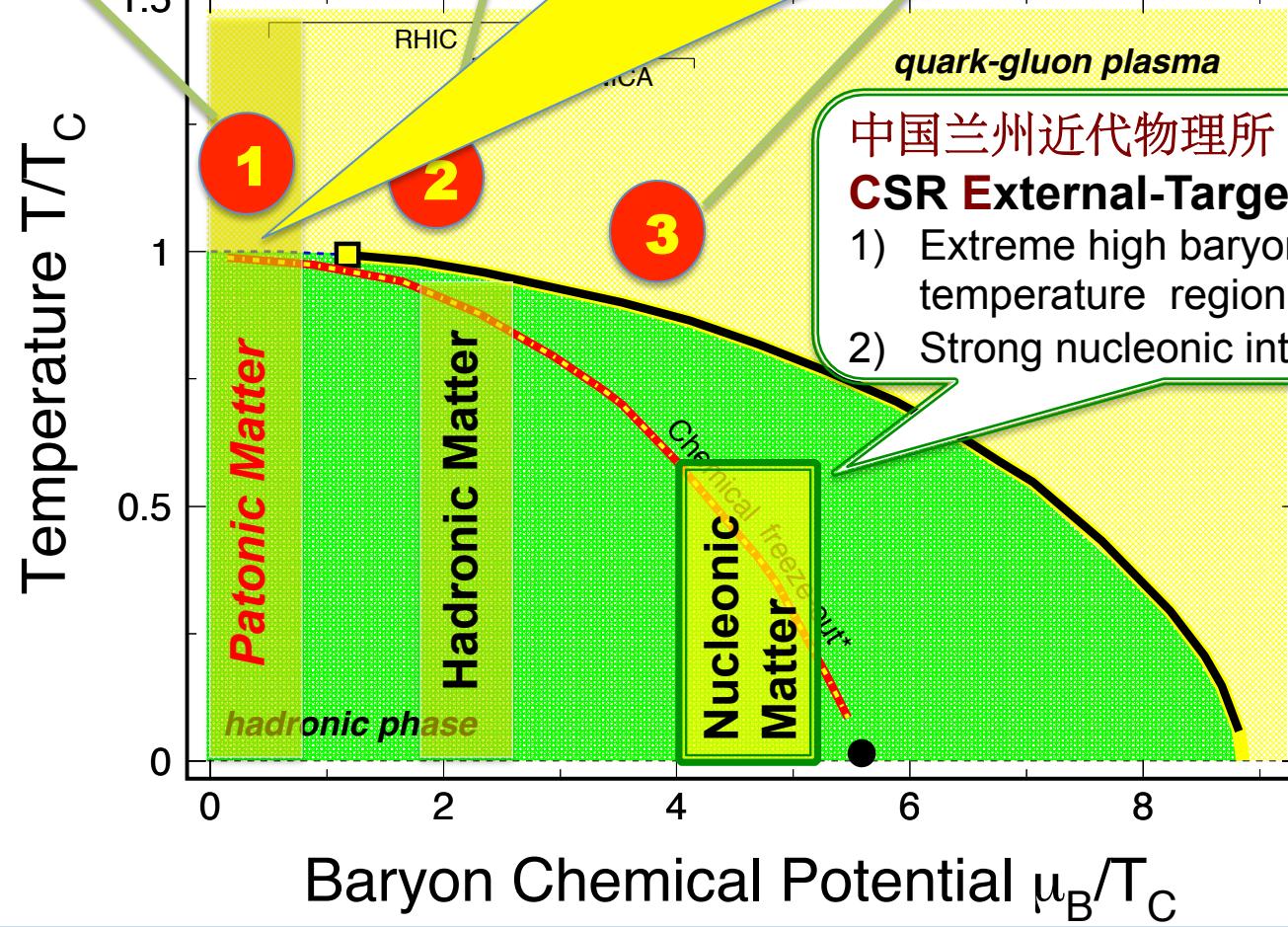
# Outlook:

## QGP Properties at RHIC and LHC (0.2 - 5.5 TeV AA and pA Collisions)

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$T_{\text{ini}}, T_c$   
**LHC, RHIC**

- Upgrade for HF hadron measurements
- di-leptons:  $v_2$ ,  $p_T$  spectra,  $R_{\text{AA}}$ , ... vs. mass



中国兰州近代物理所 CEE  
**CSR External-Target Experiment:**  
1) Extreme high baryon density and low temperature region  
2) Strong nucleonic interactions

## **CEE:**

- 1) Study ***QCD phase structure*** at extremely high baryon density
- 2) The ***base*** for Chinese nuclear physics and the ***state of art technology***
- 3) Training next generation ***scientists***